

CLAIMS

What is claimed is:

1 1. A transparent multi-layer coating for a substrate, comprising:
2 a surface-hardening layer formed over the substrate;
3 a multi-layer abrasion-resistant coating formed over said surface-hardening
4 layer; and
5 a hydrophobic dry coating formed over said multi-layer abrasion-resistant
6 coating.

1 2. The coating of claim 1, wherein said abrasion-resistant coating
2 comprises alternating layers of silicon dioxide and zirconium dioxide.

1 3. The coating of claim 2, wherein said abrasion-resistant coating
2 sequentially comprises a silicon dioxide layer, a zirconium dioxide layer, a silicon
3 dioxide layer, a zirconium dioxide layer, and a silicon dioxide layer.

1 4. The coating of claim 3, wherein said abrasion-resistant coating
2 sequentially comprises a silicon dioxide layer of approximately 907 angstrom, a
3 zirconium dioxide layer of approximately 765 angstrom, a silicon dioxide layer of
4 approximately 174 angstrom, a zirconium dioxide layer of approximately 246
5 angstrom, and a silicon dioxide layer of approximately 2616 angstrom.

1 5. The coating of claim 1, wherein said hydrophobic coating comprises a
2 perfluoroalkylsilane layer formed by a dry coating technique.

1 6. The coating of claim 5, wherein said perfluoroalkylsilane layer has a
2 thickness of approximately 5-20 nm.

428
448
701

428
448
701

428
333
428
215, 216

428
447

428
336

1 7. The coating of claim 1, wherein said hydrophobic coating and said
2 multi-layer abrasion-resistant coating are both dry coatings formed by a vacuum
3 coating technique.

1 8. The coating of claim 1, wherein said hydrophobic coating and said
2 multi-layer abrasion-resistant coating have substantially equal thermal coefficients of
3 expansion.

1 9. The coating of claim 1, wherein said surface-hardening layer is an
2 organo-silicon polymer material.

1 10. The coating of claim 9, wherein organo-silicon polymer material is
2 triethoxymethyl silane.

1 11. The coating of claim 9, wherein said organo-silicon coating has a
2 thickness of approximately 2-3 microns.

1 12. The coating of claim 1, wherein said coating is formed on a glass
2 substrate.

1 13. The coating of claim 1, wherein said coating is formed on a polymer-
2 based substrate.

1 14. The coating of claim 1, wherein said coating is formed on an
2 automotive window.

1 15. The coating of claim 1, wherein said coating is formed on an
2 automotive mirror.

428
336
428
426+
↓

1 16. A method of forming a transparent multi-layer coating over a substrate
2 comprising:

3 forming a surface-hardening layer over said substrate;

4 forming a multi-layer abrasion-resistant coating over said surface-hardening
5 layer by sequentially depositing alternating layers of silicon dioxide and zirconium
6 dioxide over said surface-hardening layer using a dry coating technique; and

7 depositing a hydrophobic coating over abrasion-resistant coating using a dry
8 coating technique.

1 17. The method of claim 16, wherein said abrasion-resistant coating and
2 said hydrophobic coating are dry coatings which are formed by a vacuum deposition
3 technique.

1 18. The method of claim 16, wherein said abrasion-resistant coating is
2 formed to sequentially comprise a silicon dioxide layer, a zirconium dioxide layer, a
3 silicon dioxide layer, a zirconium dioxide layer, and a silicon dioxide layer.

1 19. The method of claim 18, wherein said abrasion-resistant coating is
2 formed to sequentially comprise a silicon dioxide layer of approximately 907
3 angstrom, a zirconium dioxide layer of approximately 765 angstrom, a silicon dioxide
4 layer of approximately 174 angstrom, a zirconium dioxide layer of approximately 246
5 angstrom, and a silicon dioxide layer of approximately 2616 angstrom.

1 20. The method of claim 16, wherein said hydrophobic coating comprises
2 perfluoroalkylsilane.

443366 0704
TO 229 2692

1 21. The method of claim 20, wherein said perfluoroalkylsilane coating is
2 formed to have a thickness of approximately 5-20 nm.

1 22. The method of claim 16, wherein said hydrophobic coating and said
2 abrasion-resistant coating have substantially equal thermal coefficients of expansion.

1 23. The method of claim 16, wherein said surface-hardening layer is an
2 organo-silicon polymer material.

1 24. The method of claim 23, wherein organo-silicon polymer material is
2 triethoxymethyl silane.

1 25. The method of claim 23, wherein said organo-silicon layer is formed to
2 have a thickness of approximately 2-3 microns.

1 26. The method of claim 1, wherein said coating is formed on a glass
2 substrate.

1 27. The method of claim 1, wherein said coating is formed on a polymer-
2 based substrate.

1 28. The coating of claim 1, wherein said coating is formed on an
2 automotive window.

1 29. The coating of claim 1, wherein said coating is formed on an
2 automotive mirror.

00016692.072701